3.

A
DESCRIPTION
OF
INSTRUMENTS
USED BY
SURVEYORS.

The Pentagraph
Proportional Compasses
PerAmbulator
Circumferenter
Plane Table
Semi-Circle
Theodolites, four Sorts.
Parallel Protractor.

The Practical Method of finding the Altitudes and Diſtances of TERRESTRIAL OBJECTS.

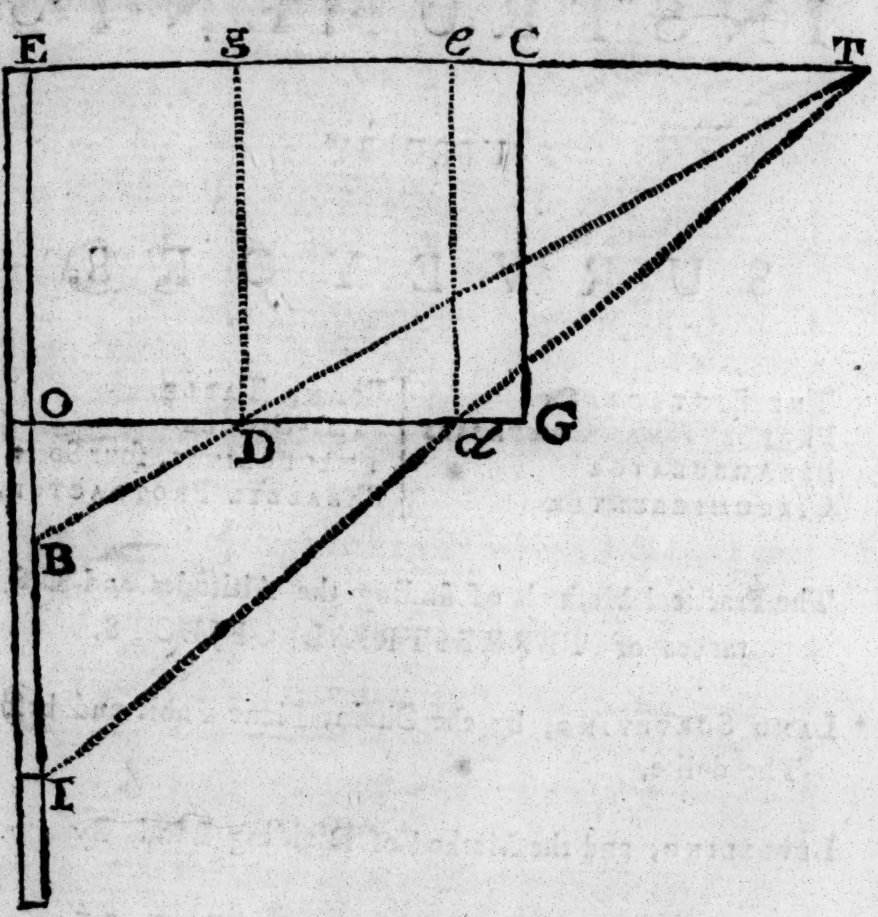
Land Surveying, by the Chain, Plane Table and beſt Theodolite.

Levelling, and the Method of Dividing Land, By

J. WADDINGTON,
Land Surveyor.

LONDON: *Printed in the Year* 1773.

Mathematical Principles of the Pentagraph.



LET the points in the figure E O G C, repreſent the centers on which the parallelogramic part moves. E the common center of the branches E T, E I; and T the place of the fixed ſocket, B and D, two ſockets moveable on the parts O I, O G. By the figure it is evident when the Fulcrum is in B, that the ratio of the moving points

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points D and T will always be as T B to T E, ſo is D B to D O, in every poſition of the line T D B, or at every diſtance of the points B and D on the parts O I, O G, and the point T; becauſe the triangles T g D, D O B and T E B are ſimilar. Whence the diſtance T B, D B are in the ſame ratio, as the ſum of the ſides T E + E B to D O + O B. Thus B T to B D, as B E to B O.

The ratio of B T to B D is always given; and E O is a fixed quantity, which is alſo known; to find O B, at every diſtance of the moveable point B, from the fixed point O, of any given ratio of T B to D B.

1. Let $BT = a$, $BD = e$, $EO = b$, and $OB = x$.

Then $a : e :: b + x : x :: ax = b + x + e = be + ex$.

Hence $ax - ex = be$, and $x = \frac{be}{a-e}$ a general theorem, with the Fulcrum in B or T.

2. Let the Fulcrum be in D, to find the ratio of the motion of the points B T. By the ſimilarity of the triangles T g D, D O B and the ratio of the parts of the line T D, D B being taken (as 2 to 3, 3 to 4, &c — to find the variable diſtance O B of a given ratio; or the point B, where the ſocket B, is to be fixed.

As $TD : DB :: gD : OB$. Put $TD = a$, $DB = e$, then will $a : e :: b : x = \frac{eb}{a}$ a general theorem, with the Fulcrum in D.

To divide and number the Pentagraph.

Lay the edge of a ſtreight ſcale or rular on the center of the point T; and on it as a center move the ruler to and fro' on the lines A, B, (ſee fig. 2, plate 1) till the diſtance T d, be the ſame as the diſtance d b; then mark the places of the bevil edges of the ſockets on the parts or lines A B C D, and draw two lines right acroſs for the extreme lines a O, b I; alſo draw the line d acroſs the lines C D. Take the diſtance between the lines a O, b I in the compaſſes, and open the ſector till the parallel diſtance 8; 8 on the line of lines be at that diſtance; and then take off the diſtances as in the firſt column of the following table; and ſet them off from the line a o, towards A and B, and number them as in the ſecond and third columns; only place the firſt term of the ratio above a line, and the ſecond under the line. Thus one to ten, will be $\frac{1}{10}$ and the reſt $\frac{1}{9}$, $\frac{1}{8}$, $\frac{1}{7}$, $\frac{1}{6}$, &c.

On the ſmaller ſize of Pentagraphs, only a part of theſe numbers are put on them.

Otherwiſe, the points of diviſion may be ſet off from a ſcale of equal parts; by applying the diſtance O I, which is to be divided, to the ſcale of equal parts, and write down the number; which number divided by the numbers 10, 9, 8, 7, 6, &c. in the ſecond column, will give the numbers to he ſet off from O to A, which will exactly correſpond with thoſe ſet off from the ſector.

N. B. That 8 : 8 on the different legs of the ſector, may be called 80 ; 80 or 800 and 800 ; that is, each of the numbers in the firſt column multiplied by 10 or 100. Note, The ratio or proportion of ſpaces or ſurfaces, included by any line or lines deſcribed, are to each other, as the ſquares of the ſimilar lines (of limits) or like parts of the ſaid lines ; whether in the perimeters of the figures (drawn and traced) or the diagonals, diameters, &c.

The Table of the Pentagraph.

	Set off from the lines a o towards I.	Fulcrum in d, ſet the ſockets to the No. on A and C,			Fulcrum in b or T. ſet the ſockets to the No. on B and D.				
	Equal parts.	Ratio of lines.			Ratio of Lines.				
Theſe Numbers are to be taken off from the Sector, parallelwiſe.	0, 80	1	to	10	1	to	11	is	$\frac{1}{11}$
	0, 89	1	—	9	1	—	10	—	$\frac{1}{10}$
	1, 00	1	—	8	1	—	9	—	$\frac{1}{9}$
	1,143	1	—	7	1	—	8	—	$\frac{1}{8}$
	1,333	1	—	6	1	—	7	—	$\frac{1}{7}$
	1,600	1	—	5	1	—	6	—	$\frac{1}{6}$
	2,000	1	—	4	1	—	5	—	$\frac{1}{5}$
	2,666	1	—	3	1	—	4	—	$\frac{1}{4}$
	3,000	3	—	8	3	—	11	—	$\frac{3}{11}$
	3,200	2	—	5	2	—	7	—	$\frac{2}{7}$
	4,000	1	—	2	1	—	3	—	$\frac{1}{3}$
	4,800	3	—	5	3	—	8	—	$\frac{3}{8}$
	5,000	5	—	9	5	—	13	—	$\frac{5}{13}$
	5,333	2	—	3	2	—	5	—	$\frac{2}{5}$
	6,000	3	—	4	3	—	7	—	$\frac{3}{7}$
	6,400	4	—	5	4	—	9	—	$\frac{4}{9}$
	7,000	7	—	8	7	—	15	—	$\frac{7}{15}$
	8,000	equal ratio 1 : 1			1	—	2	—	$\frac{1}{2}$

The uſe of the Pentagraph.

It's uſe is to copy plans or pictures.

1. When the Fulcrum is in the ſocket d, the plan will be inverted.

2. When the Fulcrum is in the ſocket b, and the pencil in d, the plan may be reduced as in the third column, in the ratio of 11 to 1, 10 to 1, &c. of 2 to 1, or to half it's ſize in reſpect of length or breadth.

3. When the Fulcrum is in b, the pencil in T, and the tracer in d, the plan may be enlarged in the ratio of the numbers in the third column —that is, to eleven times, 10 times, 9 times, &c. its length and breadth; or of 1 to 2 it's double.

When the Inſtrument is to be uſed, to deſcribe figures whoſe bounding lines or ſides, are to be in a given ratio, you muſt ſet the bevel edges of the ſliding ſockets to cut the lines which denote that ratio, as in the ſecond or third columns of the table.

4. If the Sockets be ſet to $\frac{2}{3}$, with the Fulcrum in d; then the ſpace in length will be deſcribed by the Pencil in b, to that by the tracer in T, as 2 to 3: and the Surfaces deſcribed, will be as 4 to 9; and the like of

the other Numbers. When the Pencil is uſed in the Socket T, and the Tracer in d, the Plan or Picture will be enlarged in the Ratio denoted by the Numbers.

Note, When the Fulcrum is fixed in d, the Picture will be inverted; and if the Pencil be in Socket T, the Picture will be enlarged; but if it be in b, the Picture will be reduced. When the Fulcrum is in Socket b, or T, the Picture will be erect; and if the Pencil be in T, the Picture will be enlarged; but if the Pencil be in b, the Picture will be reduced. Alſo to enlarge a Plan the moſt, put the Fulcrum in b, the Tracer in d, and Pencil in T, and fix the Sockets b and d, to the ſame No. on the Lines B and D.

The Uſe of the PROPORTIONAL COMPASSES.

The common Sort has a fixed Center, and their Uſe is to take off the Length of Lines in one of the Ends of the Compaſſes, and to lay them down by the other Ends; the Lengths of theſe Lines will be in a conſtant Ratio of the Length of their Legs, from their common Center.

The general Sort has a moveable Center, which ſlides in the Groves of the Legs, or Sides of the Compaſſes, and may be fixed at any Part of the Grove, by Means of a Nut and Screw.

On the Sides of the Groves of ſome of thoſe Compaſſes, are graved Scales of Lines and of Circles, or the like.

By the Scales of Lines, any right Line that can be taken between the Points, in one End of the Compaſſes,

ſes, may be divided into 2, 3, 4, &c. equal Parts by the Points in the other End, when the ſliding Center is ſet with its Line againſt the Line of the Number of the Ratio. To ſet the ſliding Center ſo that the two Points of the oppoſite Ends may open in a given Ratio.—Suppoſe 5 to 1, ſhut the Compaſſes, and ſlacken the Screw of the Nut, and then ſlide it till the Line drawn acroſs ſtands againſt the Diviſion denoted by the Number 5, and ſcrew the Nut faſt, then open the Compaſſes till the given Line can be taken between the longer Points of the Legs, and the Diſtance of the Points of the ſhorter Legs will be $\frac{1}{5}$ Part of the given Line: the like of other Ratios.

By the Scale of Circles, a regular Polygon may be inſcribed in a given Circle. To inſcribe a Heptagon in a Circle whoſe Diameter is three Inches, ſlide the Nut till its Line of Diviſion ſtands againſt the Line marked 7 in the Scale of Circles, there fix it, and open the Compaſſes till the Points of the longer Legs be three Inches aſunder, and then the other Points will be at a Diſtance from each other equal to the Length of the Side of the Polygon, which ſet off in the Circumference of the Circle.

Thoſe Compaſſes are of great uſe in reducing, or for enlarging of Plans, ſee Fig. 2, Pl. 1

The Uſe of a BOW-PEN.

Fig. 3 denotes a Bow-Pen, which is of great Uſe in the drawing of ſmall Curves or Circles of little Radii; they are uſed in drawing Architecture, Fortification, Gunnery and Engineering.

Of the INSTRUMENTS *uſed in meaſuring Roads, Streets, Towns and Cities,— and thoſe in ſurveying of Land.*

ART. 1 A Perambulator, Way-wiſer, or Meaſuring Wheel, is an Inſtrument for meaſuring Diſtances in Roads, Streets, &c.

2. A Circumferentor is an Inſtrument which is much uſed in America, and in ſome other foreign Countries, for ſurveying Woods and Foreſts.

3. A Plane-Table is an Inſtrument uſed for the ſurveying of Land;—by which Inſtrument the Plan of the Survey is taken on the Premiſes, when the Diſtances are meaſured. The Plane Table is moſtly uſed in taking the Ground-plot or plan of Buildings and Gardens.

4. A Semicircle for ſurveying of Land,—now out of Uſe.

5. A Theodolite is an Inſtrument for meaſuring Angles in the Fields. There are ſeveral Sorts:—The common Sort, with Plane Sights, and a ſmall Radius, is of little more Uſe than ſerving to teach Learners by. A better Sort, with Plane Sights, and 10 or 12 Inches Diameter, which may occaſionally ſerve for taking the Angles of ſmall Incloſures, or of Station Lines, whoſe Length does not exceed 10 Chains. A third Sort, which has both Plane Sights and a Teleſcope; alſo a vertical Arch, for taking Elevations and Depreſſions. A fourth Sort, commonly called the beſt Theodolite:

ſome of thoſe have Acromatic Teleſcopes, Levels, Vertical Arch, and Nonius; the Limb with a Nonius Index, by which the Poſition of Lines may be taken to 3 Minutes of a Degree; and the Elevations and Depreſſions may be taken to each 6 minutes of a Degree.

Thoſe Inſtruments and their Uſe are deſcribed in the following Pages.

Of the PERAMBULATOR.

Firſt, The Perambulator is compoſed of a Wheel and an Index Branch. On this Branch is fixed a Metal Box, with Indexes, which communicate with the Pinion of the Wheel by a Branch; over the Box is a Glaſs, and on its Bottom is a ſilver'd Plate, which has two graduated Circles:—The outer one is divided into Yards, and numbered 10, 20, 30, &c. to 220; the Yards in 40 Poles, or 1 Furlong.—The inner Circle is divided into Furlongs and Miles: the outer Numbers of this Circle are Furlongs, the inner Numbers are Miles; which are to be reckoned by the ſhort Index, Miles and Furlongs. By theſe Indexes are ſhewn the Miles, Furlongs, Poles and Yards paſſed over with the Wheel. The Indexes are to be ſet to the Beginning of the Diviſions before you begin to meaſure, from all Stations to be reckoned from.

Of the CIRCUMFERENTOR.

The Circumferentor is compoſed of a long Plate of Braſs, with Sights at its Ends, and a Braſs Box containing a Needle; the Needle traverſes on a Point or Pivot, over the Center of the Plate. On the Bottom of the Box, is a Circle divided into Degrees, and numbered from the Points marked N, E, S, W, 10, 20, 30, &c. to 90°.—Alſo, the upper Part of the Box has its Circumference divided into Degrees, and numbered from N, the North Part, both Ways, towards E and W, continued about its Circuit to 360 Degrees. Theſe laſt Numbers are of the Circumferentor; and the former, the traverſing Quadrants.

In uſing this Inſtrument, the Bearings of Lines are taken by the Needle: 1. Obſerve, that the Flower-de-luce is always to be towards you, when you look through the Sights forwards; but when you look through them backwards, at the Station you came from laſt, the Flower-de-luce muſt be turned from you. 2. Obſerve, that thoſe Bearings are magnetical, and the Variation of the Needle muſt be applied, in order to get the true Bearings;—but the Account may be kept in the Bearings as taken, and the Plot of the Land delineated accordingly; only when the Compaſs of the true Poſitions or Bearings of the Plan is to be drawn, you muſt apply the Variation.—The Method of finding the Variation, and the true Poſition of the Meridian, may be ſeen in Waddington's Sea Officer's Companion, and in moſt Books of Navigation.

Of

Of the PLANE TABLE.

The Plane Table is made of Wood, in the Form of a Rectangle, of various Sizes: ſome are made 12 inches ſquare, others 16 by 12, 18 by 14, and 22 by 16 Inches. This Plane-table has a Frame, which is generally made of Box-wood, with Joints. It is alſo divided into Degrees and Half Degrees, in reſpect of two Centers made in the Face of the Table; one of its Centers is in the Middle of the Table, the other near one of its Sides; the divided Limbs on the Frame reſpecting theſe Centers are on different Sides, and the Beginning of the Degrees, the Center and 180°, are in a Right Line, which the Index will ſhew when it is laid on thoſe Diviſions. The Index is made of Braſs, about two Feet long, with Plane Sights. Alſo there is put on the Index ſeveral Scales of equal Parts, for ſetting off Diſtances when meaſured.—There belongs to it a three-legged Staff, with Ball and Socket, or parallel Plates, and Compaſs with a Needle for taking Bearing of Places. Some of the beſt of the Plane-Tables have a Braſs Frame, which is only of Uſe to keep the Paper down on its Table; and with this Table is generally made a Braſs Index, with a parallel Ruler applied to it, by which all Poſition Lines may be drawn from any Part on the Table, and the Plan much truer delineated; on the Staff-head to this Table is always adapted the parallel Plates, and a ſpirit Level to ſet the Table by when uſed.

Of THEODOLITES.

The common Theodolite has a three-legged Staff, and a Ball and Socket, by which the Braſs Plate, or Limb of the Theodolite, with its Box, which contains a Needle, may be put into any Poſition. The Limb of this Inſtrument is divided into Degrees. There are two Sights made to ſlide on to the Nuts of the Limb; which Sights are fixed. The Index Plate moves on the Center of the Plate of the Limb, with a Metal Box and Needle; and there are two Sights made to ſlide upon the Nuts, near the Ends of the Index. This Index, with its Sights, is moveable; and at one End of it is a Nonius Diviſion, by which the Degrees of the Limb are ſubdivided each, into five Minutes; the Nonius is numbered 10, 20, 30, 40, 50, &c. and thoſe numbered Diviſions are ſubdivided; therefore the twelve Diviſions of the Nonius being made equal to eleven Diviſions of the Limb, whence the Method of reckoning them is as follows: The upper Numbers are to be reckoned the contrary Way to that of the Limb; the Limb is numbered from the North Point, Eaſt about, to 360°.

When the Inſtrument is to be uſed, bring the Index into a Poſition, that the fiducial Line of the Nonius (that is, the Line from which its Diviſions are to be reckoned) ſtand over the firſt Line on the Limb, which is numbered 360; there make it faſt, and obſerve if the Hairs of all the four Sights be in the ſame Right Line, if they be not, they muſt be made to be ſo, before the Theodolite be fit to be uſed.

To Take the Poſition of the Lines by the Limb.

Turn the Theodolite about by its Ball and Socket, till the North Point of the Needle ſtands againſt the North Point of its Box, then ſcrew the Ball faſt, and turn the Index till you can ſee an Object through its Sights, and the Nonius will ſhew the bearing of that Object; but it will be its bearing by the Needle, which is called Magnetical, and it deviates from its true bearing or poſition in reſpect of the Meridian, by the variation of the Needle, which at London, in the beginning of the Year 1772, was very near 21 Degrees Weſt, from the true North: The annual variation is nearly 11 minutes increaſing.

I take it to be the beſt method, to ſet the Theodolite in a poſition with the Needle, to point to the Variation, that is, the North Point to ſtand againſt 21° towards the Weſt, and then 360° and 180° on the Limb, will be in direction of the true Meridian. The Needle ſhould always ſtand ſo at every Station.

The third Sort of Theodolites, has parallel Plates, with 4 adjuſting Screws to fix on the Staff-head, the Theodolite fixes to it, by a conical Socket and a Screw, on the center of this Inſtrument is fixed a metal Box, with a Needle and a Circle divided into Degrees: On the Limb moves the Nonius of the Index, with a Teleſcope and a Vertical Arch to take Angles of Elevation and Depreſſion; alſo to this Theodolite, is adopted two Levels, ſet at right Angles to one another, for the more ready adjuſting the Plane of the Horizontal Plate, or Limb of the Theodolite to its Horizontal Poſition

The fourth ſort of Theodolites, has parallel Plates and adjuſting Screws, croſs Levels, Box and Needle, Teleſcope and Vertical Arch, as above deſcribed; alſo rack work to both its Horizontal and Vertical Motions, the Nonius of the Limb contains twenty diviſions, by which, the degrees of the Limb are divided into each three Minutes, and they are numbered 10, 20, 30, &c. to the fiducial line.

The vertical Arch is divided into degrees, and it has a Nonius of twenty, by which its Arch may be reckoned to each three minutes* of a degree. On one ſide of this Arch is Links, half and quarter Links, for to ſhew the deduction to be made (when you Meaſure up or down Hill) for each Chain's length, by which your hypothenuſal Line will be reduced to a horizontal Line, which allowance muſt always be made before you can lay the length of ſuch Line or Lines down on the Plan, which can only be repreſented there, as the Plans of Surveys of Eſtates are all Horizontal. Suppoſe a Line meaſured 1142 Links, where the Arch of the Elevation gave $6\frac{1}{4}$ Links to be deducted for each Chain;

Multiply	1142	From	1142
by	$6\frac{1}{4}$	Take	71
	6852	Rem.	1071 the horizontal Line.
	$285\frac{1}{2}$		
	$71,37\frac{1}{2}$		

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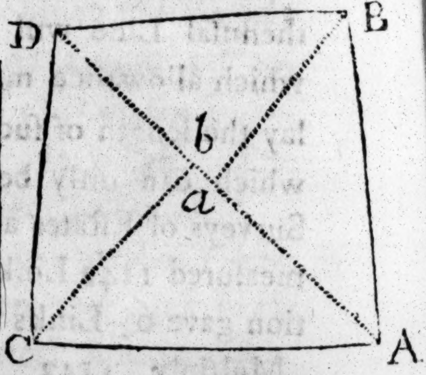
* Note, 3′ denotes Three Minutes.

Of LAND SURVEYING.

This Art is principally performed with a Gunter's Chain, which contains one hundred Links; its length is Twenty-two yards, or Sixty-ſix feet; this Chain with ten Pricks or Arrows about fifteen Inches long, and an Offset Staff of ſix, ſeven, eight, or ten Links, and a Square or right Angle to fix on it occaſionally by a finger Screw, it may be fixed to any part of the Offset Staff; by theſe the Surveyor may Survey any piece of Land that is level, or nearly ſo, and where no Obſtacles interpoſe, as Lakes, Rivers, Towns, &c. tho' the Field or Foreſt be ever ſo large.

FIELD BOOK of the fig. ABCD.

Remarks	Offsets. Left	Station Lines.	Offsets, Right.	
		1. ⊙ at A		
a to B	1600	1650	at a.	
	at b.	1820	1770	b to C
Diagonal		3344		



Having viewed the Field and obſerved the Fences to be ſtraight, I began at A and Meaſured right towards D; in this Line, by my Square I find the Perpendicular from B will meet the Diagonal AD at the point a, I then Meaſured from a to B and returned to a, and I then found the Perpendicular from C fall at b; I Meaſured to b, which being entered in the Field Book, I Meaſured b C, entered it, and proceeded to D, where I found the whole Diagonal to be 3340 Links, or 33 Chains and 40 Links.

CHARACTERS

CHARACTERS uſed in the MATHEMATICS.

Characters.	*Significations.*
+	More, to be Added, as $2+3$ is 5.
—	Leſs, to be Subſtracted, as $7-3$ is 4.
×	Times, Multiplied by, as 6×3 is 18, or $A\times B$ is AB.
÷	Divided by, as $6\div2$ is 3, or $\frac{6}{2}=3$.
=	Equal to, as $6=2\times3$. and $36=9\times4=6\times6=3\times12$.
: :	Geometrical Proportion, A : B : : C : D, that is, as A is to B, ſo is C to D.
An.	Angle ; S, Sine ; coſ, coſine ; R. Radius.

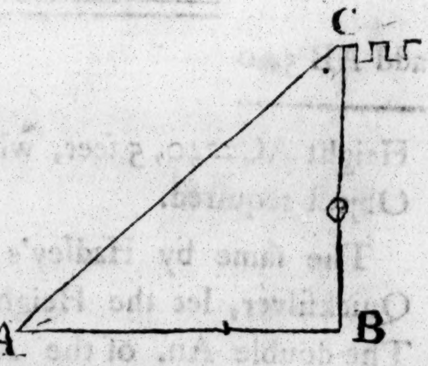
Plane Trigonometry applied to Altimetry and Longimetry, or the Art of Meaſuring the Heights and Diſtances of Objects, both acceſſible and inacceſſible.

PROBLEM I.

To find the height of a Tower B C, by having given the diſtance BA 350 Feet, and the Horizontal An. at A 40°. 3′0.

As the Coſ. An. A 40° : 30′ = 0,118954
: S, of An. A 40 : 30 = 9,812544
: : Diſt. A B 350 : = 2,544068

: Height B C 299 ft. = 2,475566



Note, the Place of the apparent Level on the Object, muſt be marked, and its height above the bottom of the Object muſt be added to the height obtained by the above Problem.

Let G in Fig. 2, repreſent the Place on the Ground where the Theodolite ſtands; G H the Height of the Center of the Teleſcope; H B the apparent Level, as ſhewn by the Horizontal Wire in the Teleſcope, which Point of the Level muſt be marked againſt the Object, and that height above the Ground muſt be added to the Altitude obtained by Trigonometry.

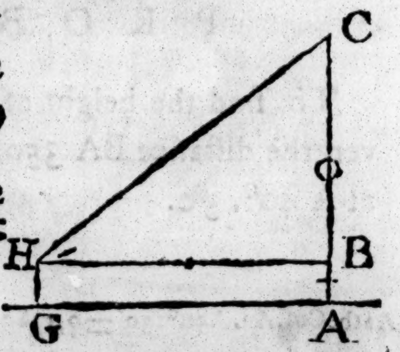
EXAMPLE II.

By the Theodolite, I found the An. BHC=36° : 27′, and the meaſured Baſe GA=HB=48 feet, the Level of the Inſtrument ſhewn by the Wire in the Teleſcope HB, and the Height above the Ground againſt the Wall AB, 5 feet. To find the Height BC.

As S, An. C 53° : 33=0,0945411
: HB . . 48 feet =1,6812412
: : S, An. H 36° 27′=9,7738749

: BC 35, 5 feet. =1,5496572

add AB 5, 0



Height AC=40, 5 feet, which is the Height of the Object required.

The ſame by Hadley's Quadrant and a Baſon of Quickſilver, let the Height of the Baſon be $3\frac{1}{2}$ feet. The double An. of the Altitude =74° : 50′
Hence the An. of Altitude is 37 : 25=Horizontal An. H.
Its compliment to 90° is 52 : 35=Vertical An. C.

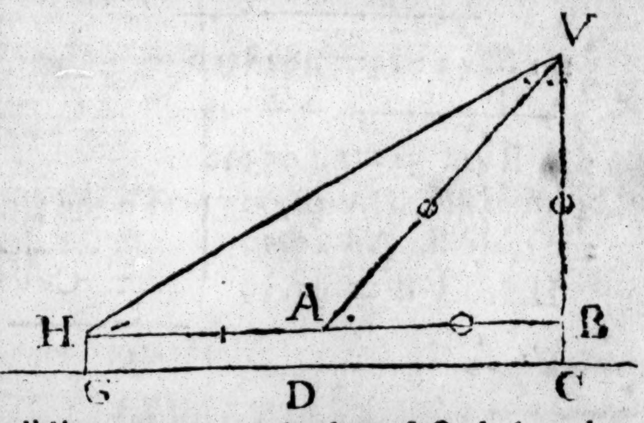
As S 52° : 35′=0,1000494
: S 37° : 25′=9,7836227
: : - - 48 feet =1,6812412

: 36, 72 feet =1,5649133
3, 5

Ht. 40, 22=AC, as before nearly; which is the height of the S. W. Corner of the Royal Academy at Portſmouth.

PROBLEM II.

To find the Altitude and Diſtance of an inacceſſible Object.



Let the Point of the Figure at H, repreſent the Center of the Teleſcope of the Theodolite, which being adjuſted and level'd, ſuppoſe the Point B of a Building appears to be interſected by the Horizontal Wire of the Teleſcope, Mark the Place B, and elevate the Teleſcope till you ſee the ſame Wire cut the Top of the Object at V, reckon the An. of Elevation on the Arch, and enter it in your Book; then meaſure from G to D=HA, ſet the Inſtrument at D, and adjuſt it as before, and take the An. of Elevation of the Point of the Object at V, which Note, and then ſay, As the S of the An. A VH : S, An. H : : HA : AV.

2d. As R : AV : : S, An. AVC : AB.

3d. As R : AV : : S, An. A : BV. And BV + CB =CV. the Altitude. Let the An. H, be 29° 10′, the An. BAV=47° 41′; HA=48 feet. Now the An. A —An. H=18° 31′=An. AVH, As S, 18° 31′=0,498146

: 48 ft. =1,681241
: : S, 29 : 10=9,687842

: AV 73,7=1,867230

2d. R : 73,66=1,867230
: : S, 47:41=9,868900

: alt. BV 54,47 ft. 1,736130

: : S, 42 : 19=9,828162

: AB 49, 59=1,695392

To the diſt. HA	48,00	To the alt. BV	54,47
add the diſt. AB	49,59	add the alt. CB	5,6
Diſt. H B =	97,59	Alt. C V =	60,07 ft.

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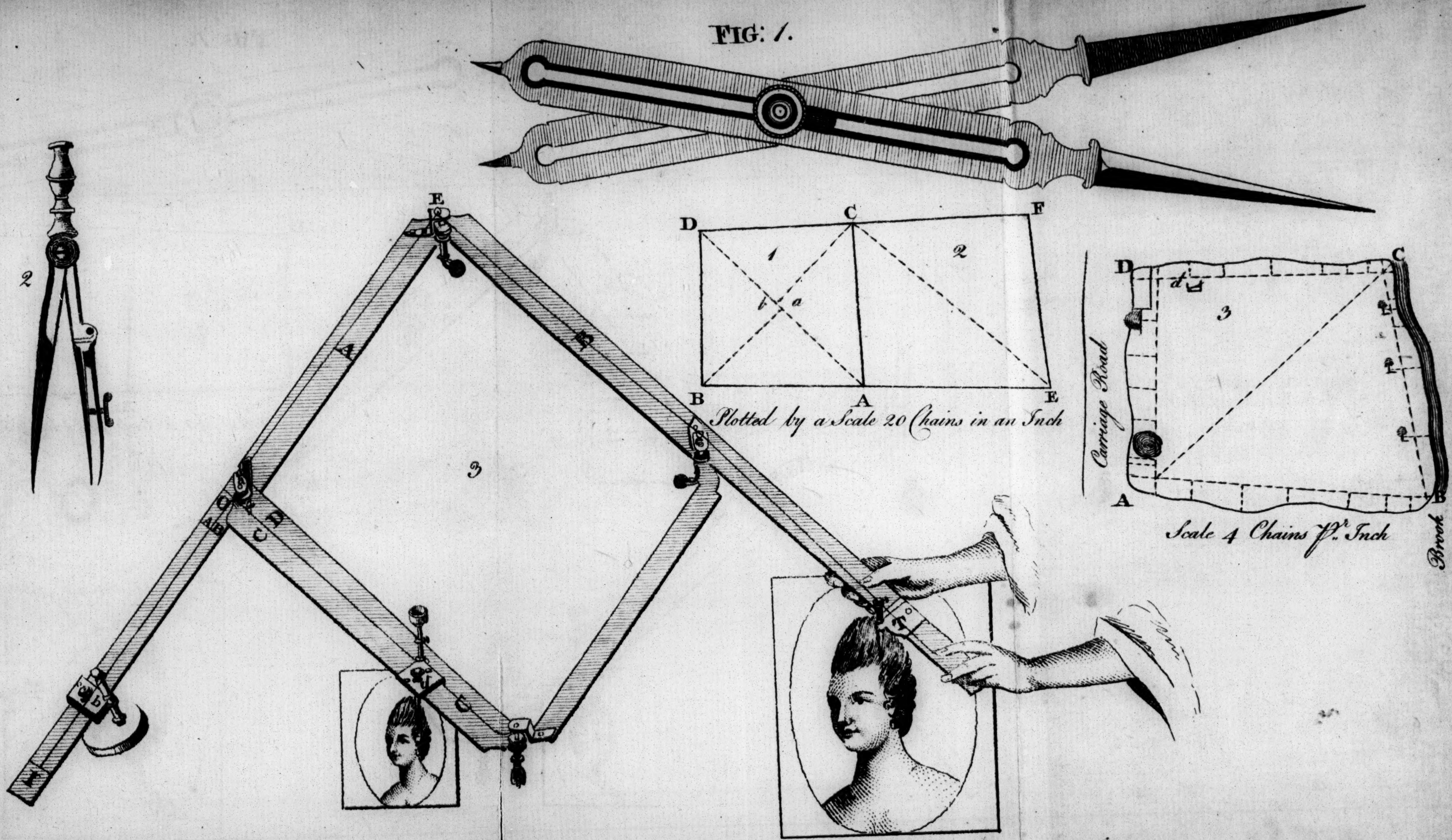
FINIS.

FIG: 1.



Plotted by a Scale 20 Chains in an Inch

Scale 4 Chains pr. Inch